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# Terms of Reference

# Renewable Energy Mapping: Small Hydro

## BACKGROUND

*<Rationale for the project, project history and list of relevant studies, key steps, need for consultancy services in the project, issues to be resolved, source of financing, country context, project context. >*

## OBJECTIVES

*<General Notes: Typical project objectives of an assignment may include the following: sector and strategy studies or assessments, project management and implementation supervision, collection and data analysis, etc.>*

This TOR document outlines a mapping project that aims to improve the quality and availability of information on [Country]’s small hydropower resources. The project will provide the [Partner] and commercial developers with ground-validated maps that show the varying levels of hydro potential throughout the country, and highlight several sites most suited for small hydropower projects.

These resource maps are: (i) to contribute to a detailed comprehensive assessment and to a geospatial planning framework of small-hydro resources in [Country]; (ii) to verify the potential for the most promising sites and prioritized sites to facilitate new small hydropower projects and ideally to guide private investments into the sector; and (iii) to increase the awareness and knowledge of the [Partner] on RE potential.

Outputs

Outputs from the mapping and geospatial planning activity will fall into a number of categories, including: i) data; ii) GIS layers; iii) atlas report; and iv) policy recommendations. The latter might be a non-exhaustive list of potential next steps towards a RE legislation and/or support to private investors, etc.

## SCOPE of WORK

*<General Notes: This section of TOR details all the main activities to be conducted by the consultants and expected results of those activities. TOR should describe only the activities, not the approach or methodology by which the results are to be achieved>*

This assignment includes the following phases of small hydro resource assessment:

Phase 1 – Initial scoping and mapping: Undertake a comprehensive scoping exercise, including a country visit to source and evaluate existing datasets, identify key stakeholders and data gaps, develop initial mapping outputs based on existing global and country-level datasets, site visits to verify sites, prioritization and identification of data gaps;

Phase 2 - Data collection and validation: Based on the findings from Phase 1, carry out a detailed data gathering and validation exercise through targeted site investigations and/or commissioning of a stream gauge data campaign for a minimum of 18 months;

Phase 3 - Production of validated small hydro atlas: Prepare validated small hydro resource maps describing national resource potential and highlighting promising site locations, backed up with high level site information and feasibility analysis.

Phase 2 of the assignment will focus on a few regions in [Country] – ideally [Regions].

### PHASE 1: INITIAL SCOPING AND MAPPING

#### Inception: Pre-diagnostic of small hydropower potential

Upon signing of the contract, the consultant shall collect and compile relevant data and information regarding small hydro development in [Country]. It is anticipated that the consultant will need to travel to the country in the early stages of Phase 1 to carry out an Inception Mission, including meetings with the [Partner], the [Donor] team and relevant stakeholders. The cost of doing so shall be included in the Financial Proposal.

Following the Inception Mission, the consultant shall review compiled data and information, including the feedback from meetings, to refine the focus of the study, and to finalize the detailed methodology. Special emphasis shall be given to complement previous work on small hydro potential and avoid duplication. The studies or respective documents will be provided to the successful consultant. For the purpose of this study ‘small hydro’ shall be defined as having a generation capacity of between 1 to 10 MW, including both grid-based and off-grid schemes, but the precise focus of the study will be determined in the Inception Mission.

The findings of the pre-diagnostic exercise shall be summarized in an Inception Report, which will require approval by the [Partner] and the [Donor] team for the continuation of the services. The results from the Inception Report shall be presented at a Decision Meeting by the consultant’s management team, for discussion and decision on the final methodology. It should be assumed that the Decision Meeting will be held remotely. However, the consultant is requested to provide a quote for attendance at a physical meeting to be held in [City], to be included in the optional components section of the Financial Proposal.

#### Mapping: Production of initial country-wide resource maps for small hydro

The consultant shall compile all necessary temporal and spatial data (e.g. hydrology and topography) to allow an analysis of hydropower resources in [Country]. If necessary, local data shall be augmented by global data sources.

Based on the compiled data, the consultant shall create a map that reflects where the varying degrees of hydropower potential are in [Country]. This map will include sites marked as having a high potential for small hydro. In their Technical Proposal the consultant shall describe in detail how such map layers will be computed. This methodology can then be revised during the pre-diagnostic exercise, based on data availability. The methodology described by the consultant in the proposal must be flexible to encompass small hydro up to 10 MW.

In the creation of the initial small hydro map, existing information from previous studies, as well as schemes under preparation shall be included. The compilation of data of small hydro schemes planned or under development shall be completed to ensure all such information is taken into account. The results from previous studies in regard to stream flows and specific generation schemes shall be used as much as possible to validate the small hydropower potential map.

All spatial data collected by the consultant will need to be visualized and stored in the [Donor]’s GIS platform. This platform will be able to display and analyze new data generated by the consultant and as well as historical data from previous studies if this is made available. All spatial data will need to comply with the standards specified in **Annex A**.

The consultant shall conduct site visits to at least [number] of the most promising sites identified in their desk-based assessment of small hydro potential. The overall potential of each site shall be verified and a rough conceptual design that includes a cost estimate for construction shall be derived. Possible risks, such as geological, hydrological, environmental or social risks, shall be noted. To enable an early indication of potential verified sites, it is proposed that the site visits are conducted in a first major campaign to coincide with the Inception Mission, followed by a second complementary campaign sometime following this.

The findings of the site visits shall be incorporated into the [Donor]-hosted GIS platform by providing the [Donor] with a fully geo-referenced database containing details on each site, photographic images, and any other site survey outputs.

#### Gap analysis: Prioritization and data gap identification

Based on the results of the initial mapping exercise, the Consultant shall carry out a prioritization of the small hydro sites. The Consultant shall develop a multi-criteria analysis methodology, including the following potential factors:

* Average and firm power potential of site
* Local electrification demand and/or transmission access
* Land access issues
* Protected and environmentally sensitive areas
* Military and other exclusion zones
* Ease of access for commissioning and maintenance purposes
* Security issues
* Assessment of possible long-term climate change impacts
* The [Donor]’s Safeguards policies

For the top [number] prioritized sites the Consultant shall define gaps in information or data to validate these schemes. Such gaps might include low spatial resolution of topographical data, limited or uncertain hydrological data, uncertainty in geological characteristics crucial for the suggested design, and unclear settlement or land ownership data. Suggestions on necessary measurements to mitigate these data gaps shall then be made.

#### Reporting and Phase 1 workshop

The Consultant shall summarize the methods and results of the initial country-wide resource maps for small hydro, including the findings of conducted site visits, into a draft Small Hydro Mapping Report. The report shall include maps created from GIS layers, and shall present the preliminary prioritization and recommendations for data gap mitigation. The methodology and results shall be presented in a transparent way. The draft report shall be ready and distributed at least two weeks ahead of a workshop to be held at the conclusion of Phase 1.

Once draft Phase 1 outputs have been submitted and approved by the [Donor], the Consultant shall participate in a three day workshop held in [City] to present the results to the [Partner], discuss next steps, and provide a package of training. As far as possible, the workshop will be timed to coincide with scoping studies and the presentation of the outputs from parallel work on other RE resources. The Consultant’s Technical Proposal shall propose a format for this event, including a description of the in-country training for end users (government and regulatory officials, representatives from utility operating companies, potential wind developers). The Consultant should assume in their proposal that the [Partner] and/or the [Donor] will host the event, including provision of meeting room space, logistics, translation and sending of invitations. The Consultant’s proposal shall include the cost of their participation in this workshop including delivery of the training components.

Based on the feedback from the Workshop, the Consultant shall revise and finalize the Small Hydro Mapping Report for approval by the [Donor] in consultation with the [Partner].

#### Detailed planning for Phase 2

It is envisaged that a minimum fixed amount of [Budget] will be available specifically for monitoring and investigations as part of Phase 2, including stream gauge measurements over a period not less than 18 months (corresponding to two dry seasons). This provisional budget will cover all in-country costs associated with obtaining the required data, including purchase of equipment (and associated import fees if relevant), procurement of contractors for necessary civil works, installations and geotechnical, geophysical, and /or topographical surveys. Local contractors and/or public agencies shall be used as much as possible.

The Consultant shall prepare a Phase 2 Implementation Plan detailing the proposed monitoring and site investigations to be conducted during Phase 2 for the prioritized sites to validate these for further development. The choice of monitoring and investigations for Phase 2 shall be based on the recommended data gap mitigation measures in the Report, including the feedback obtained at the Phase 1 Workshop, as well as the available budget (minimum [Budget]) and time span of the project.

It is anticipated that the provisional budget for monitoring and investigations shall cover the validation of the [number] highest priority small hydropower sites, but if this is not the case the Consultant shall clearly justify any deviation. The Phase 2 Implementation Plan shall include a detailed description of the proposed type of equipment and investigations needed, and the level of detail and resolution required. The Phase 2 Implementation Plan shall further include a description of the expected outputs of the proposed monitoring and investigations, and how these will be used to validate the initial country-wide resource maps for small hydropower.

Based on the results of Phase 1 the [Donor] will determine whether to proceed with Phases 2 and 3 in consultation with the [Partner] and taking into account the available budget. If the decision is taken to proceed then the [Donor] will, in consultation with the [Partner], prepare a revised Scope of Work for Phases 2 and 3 drawing on these TOR and including further details on [Partner] involvement, such as equipment ownership, importation responsibility, and operation and maintenance arrangements. The Consultant will then be required to submit a revised Technical and Financial Proposal for Phases 2 and 3, drawing on the fixed cost elements contained in their original Financial Proposal in response to this RFP and also the day rates agreed under their Delivery Agreement with the [Donor]. If this is accepted by the [Donor] then an amendment to the original contract will be signed to allow the work to proceed.

### PHASE 2: DATA COLLECTION AND VALIDATION

Phase 2 of the project includes the execution of monitoring and technical investigations to validate the initial country-wide resource maps for small hydropower. This phase will span a minimum [number] month period, with the option to extend this in periods of [number] months, and will follow the revised Scope of Work defined and agreed at the end of Phase 1. The Consultant’s Financial Proposal shall provide cost information for a measurement campaign of [number] months duration, plus the cost of three six month extensions (provided in the discretionary section of the Financial Proposal).

A minimum of [Budget] has been allocated for the Phase 2 measurement campaign. This budget is to cover the cost of procuring, commissioning, maintaining and providing security for the measurement equipment, and *cannot* be used for associated fees or reimbursements by the Consultant. The fixed cost of [Budget] shall be included in the Financial Proposal, but this will be equal for all Consultants. Separately from this, the Consultant shall include in their Technical and Financial Proposals the description and costs for person-hours, administration and overheads associated with planning, procurement, and purchase of equipment (including necessary clearances), as well as management and supervision of conducted work, installations and investigations by hired contractors. If the revised Scope of Work issued at the end of Phase 1 alters any of these assumptions then the Consultant’s Financial Proposal can be revised to reflect this. Any upward revision will be subject to negotiation which will be based, as much as possible, on the quoted unit costs provided in the original Financial Proposal.

For the purpose of their Financial Proposal, the Consultant shall assume the installation of [number] hydrological stations, and standard topographical and geotechnical/geophysical investigations (no core-drilling assumed) for [number] stations. The Consultant’s Financial Proposal shall specify any additional management or supervision costs that would apply if one or more additional sites were included in the final scope, up to a maximum of [number] sites. For the purposes of estimating costs the Consultant should assume a high degree of geographic diversity (i.e. sites spread across all hydro-relevant parts of the country) and reasonable road access.

#### Hydrological measurement program

It is envisaged that Phase 2 will include hydrological monitoring for at least [number] locations to validate the inflow estimates for potential small hydro sites. The precise number and types of hydrological monitoring stations will be detailed in the end of Phase 1. For hydrological monitoring, the Consultant will be responsible for obtaining high quality stream gauge data over an [number] month minimum measuring period.

Equipment ownership details will be finalized during Phase 1 and incorporated into the revised Scope of Work, but may include Consultant ownership (for the life of the measurement program), joint Consultant-[Partner] ownership, or ownership transfer from the Consultant to the [Partner] upon commissioning. Note that the precise details with regard to legal ownership will not change the requirement for the Consultant to be responsible for all matters relating to commissioning, operation and maintenance of the equipment for the entire measurement period.

It is preferable (but dependent on site conditions) for the measurement equipment to remain in place for longer than the limited period possible under this project in order to provide a continuous reference data series to be used for recalibrating future local hydrological measurements to a long-term normal year. As a result, the presumption is that regardless of the ownership option agreed for the measurement campaign, sole ownership of the equipment will be passed to the [Partner] once the contracted period ends. This would be structured to begin on the day immediately after the required number of months of measurement data are obtained for all sites.

The Consultant shall provide a description of the capacity building they would offer to enable the [Partner], or the [Partner]’s nominated agency/organization(s), to take over operation and maintenance of the equipment at the end of the contracted measurement period. As a minimum, the Consultant is expected to train nominated personnel (to be specified in the revised Scope of Work for Phases 2-3) to carry out continuing measurements through training in station maintenance, data quality control and both remote and on-site (emergency) data collection. The Consultant shall also invite nominated personnel to attend equipment commissioning, and will supply checklists for both maintenance and data collection. The Consultant is encouraged to specify any existing relationships they have with local agencies or suggestions in this regard. As part of the revised Scope of Work issued prior to commissioning of Phases 2 and 3, details of any local agency or partner that the Consultant will be required to work with, and the nature of the proposed collaboration, including responsibilities in terms of permitting and payment of import duties, will be provided.

The safe installation and operation of any measurement equipment, including site maintenance and security, will be the responsibility of the Consultant or their nominated sub-contractor and/or local partner agency for the duration of the project. With regard to site security, the Consultant is required to ensure the following:

* Any security arrangements put in place by the Consultant shall be proportional and appropriate.
* The Consultant shall be guided by good international practice and applicable law in relation to the hiring of security personnel (e.g. due diligence on the past conduct of the security personnel), rules of conduct, training, and equipment provision.
* Appropriate oversight and control measures of security personnel shall be in place.
* Information will be made available at each site on appropriate contact persons in case of queries or concerns.
* The procurement of arms and ammunition, nor for the training of security workers in the use of arms.

The Consultant will be responsible for all third party liabilities associated with such equipment over the course of the measurement campaign. It is suggested that the Consultant includes estimated insurance costs in their Financial Proposal on the understanding that detailed quotations will be obtained once the revised Scope of Work is issued and included in the Consultant’s revised Financial Proposal.

Hydrological data collection shall be conducted in compliance with international standards and technical requirements. The Consultant shall upload all data to a secure, online data repository that will be hosted and managed by the [Donor]. All submitted flow data will be freely available to the public (either immediately or after verification, as decided by the [Donor] in consultation with the [Partner]). The repository shall hold the measurement data, and its respective metadata for each station generated over the course of the project. The measurement data and metadata will all be the property of the [Donor]. The Consultant will be responsible for delivering data up until the end of the project. Further details on data specifications can be found in **Annex A**.

Once the contracted measurement period has passed, the Consultant shall prepare a Hydrological Resource Report covering all investigated sites. The purpose of the report is to provide a commentary on the hydrological data obtained, explain how this may be used to validate the results of the Small Hydro Mapping Report, and to provide a pre-feasibility analysis on each of the shortlisted site locations.

#### Site investigations

It is envisaged that in addition to the hydrological monitoring Phase 2 will also include limited technical investigations (such as geotechnical, geophysical and/or topographical surveys) to validate the technical feasibility of the most prioritized small hydropower sites. The Consultant will be responsible for procuring and supervising the site investigations, and subsequent laboratory analysis and assessment of results. It is assumed that all such investigations will be conducted during one dry season following directly after Phase 1.

The Consultant shall supervise the site investigations to guarantee they are conducted according to international standards. The Consultant shall perform quality control on the results of the investigations and laboratory analysis.

After the completion of the site investigations and laboratory analysis, the Consultant shall consolidate the results, and transform them into meaningful characteristics of the investigated sites. This shall be summarized in the Site Investigation Report covering all investigated sites.

### PHASE 3: PRODUCTION OF VALIDATED SMALL HYDRO ATLAS

The Consultant shall consolidate the results from the hydrological monitoring and site investigations, and use this latest data to update the small hydropower potential mapping outputs from Phase 1. A draft validated Small Hydro Atlas shall then be delivered to the [Donor] and the [Partner] in the format of a stand-alone report, slide pack, and relevant GIS layers. The Small Hydro Atlas report shall provide a summary of the methodology and process, references to the previous report and data outputs, and high quality representations of the final mapping outputs. It shall be delivered in electronic format suitable for print and web publication.

It is anticipated that a second workshop would be organized at the end of Phase 3 to present the outputs to the [Partner] and in-country stakeholders, at which time the Consultant will be expected to participate alongside any local partners involved in carrying out the work.

## Deliverables / specific outputs

*<General Note: The assignment reporting requirements should be clearly specified and balanced. Consultants should not be forced to spend an excessive amount of time preparing minor reports. TOR should also indicate the formant, frequency, and content of reports as well as the number of copies, the language, and prospective recipients (without disclosing the names)>*

All deliverables shall be written in [Language] and presented to the [Donor] and the [Partner] in electronic format suitable for online publication unless otherwise specified. Should the [Donor] decide to print any of the outputs then this will be handled separately.

### PHASE 1 DELIVERABLES

During Phase 1 the Consultant shall deliver the following:

1. Inception Report on the pre-diagnostic of small hydro in [Country], including detailed methodology
2. Small hydro resource database with the required statistics and relevant GIS. The GIS data should follow the guidelines described in **Annex A**.
3. Small Hydro Mapping Report outlining a list of prioritized sites and identified data gaps for validating the potential.
4. Inputs to the Phase 1 Workshop to be held in [City], including training and capacity building.
5. Preparation of revised Technical and Financial Proposals for Phases 2-3 if the [Donor] (in consultation with the [Partner]) decides to proceed beyond Phase 1.
6. Implementation Plan for ground-based hydrological monitoring and site investigations for Phase 2 (provided regardless of decision on whether to proceed to Phase 2).

### PHASE 2 DELIVERABLES

During Phase 2 the Consultant shall deliver the following:

1. Implementation of hydrological monitoring campaign (including quality assurance) and transfer of ownership of the measurement equipment to the [Partner].
2. Hydrological Resource Report on installed stations, including observed data
3. Training of nominated [Partner] country staff to carry out continuing hydrological measurements through training in equipment maintenance, data quality control and data collection. The Consultant will also supply checklists for both maintenance and data collection.
4. Implementation of site investigations leading to preparation of a Site Investigation Report, including all observed data and their interpretation.

### PHASE 3 DELIVERABLES

During Phase 3 the Consultant shall deliver the following:

1. Final validated Small Hydro Atlas to be delivered as a stand-alone report and accompanying slide pack for presentation to the [Partner].
2. Provision of requisite GIS layers in the specified formats.
3. Input to a Phase 3 Workshop to present the results to the [Partner].

### ANTICIPATED TIMELINE

The contract period for the Services is anticipated to be [number] years, of which Phase 1 will be [number] months.

[Table with the proposed timeline]

If the Consultant feels that the timeline proposed above is unrealistic, or that meeting it will substantially increase costs, then they should propose an alternative timeline in their Technical Proposal and/or note any constraints on their side.

## Specific inputs to be provided by the [Donor]

*<General Note: In order to avoid overestimating the Counterparts’ contribution, all counterparts inputs e.g. office space or etc., should be defined in TOR.>*

## Special terms and conditions / specific criteria

The evaluation of proposals will be conducted according to an [number]:[number] split between the Technical and Financial Proposals.

Technical Proposals, which should be no longer than [number] pages, will be evaluated against three criteria, as follows:

1. The methodology, broken down into the three Phases that come under this RFP, and assessed according to methodological rigor, the appropriate sequencing of activities, the comprehensiveness of the approach with regard to quality standards and safeguards, and the value added in terms of innovative approaches and/or improvements to the TOR.
2. The proposed team, assessed according to their combined and individual experience, appropriate balance between roles and use of senior/junior staff, and clear line of sight with regard to responsibilities.
3. Other factors, including appropriateness of the capacity building plan, proposed plan for engagement with [Partner] and external stakeholders, involvement of local partners and service providers, and the stated flexibility of the Vendor in being willing and able to respond to minor changes during implementation.

The Consultant shall provide a Financial Proposal that conforms to the terms (and specified unit rates) of the existing Indefinite Delivery Agreement (Framework Contract), and includes:

A fixed cost offer for each of the three Phases as specified in the Scope of Work, broken down by deliverables.

A fixed cost offer for the project extensions and optional components specified in the Scope of Work, including:

1. the management costs associated with additional data collection sites over and above [number], up to a maximum of [number];
2. the management costs associated with extending the measurement campaign by three periods of six months beyond the [number] month minimum.

A fixed cost offer for any deliverables that are not listed in these TOR but that are being proposed by the Consultant in their Technical Proposal as optional additions to the Scope of Work.

Any optional/additional deliverables shall be offered on a fixed cost basis and would be agreed upon in the contract negotiation phase or during project implementation.

A breakdown of personnel costs and estimated reimbursable expenses.

A proposed payment schedule against major milestones/deliverables, following an initial payment of [number]% of the total for Phase 1 on contract signing, and [number]% of Phases 2-3 on contract extension.

The Consultant is required to use the special template provided for their Financial Proposal and disregard the standard ‘Financial Proposal Template’. The Consultant shall provide their offer in the currency specified in their Delivery Agreement, and alter the Financial Proposal accordingly.

All travel charged by the Consultant shall be for economy class flights via the most direct route; [Donor] negotiated rates for hotel accommodation shall be used where possible. All travel and subsistence shall be treated as a reimbursable expense but the Consultant shall provide estimated costs in their Financial Proposal and include this in their fixed price offer.

The [Donor], at its sole discretion, may decide not to continue the work beyond Phase 1, depending on the conclusions drawn from the Phase 1 outputs and the wishes of the [Partner].

## Annex A: Requirements for data, maps and images

### NON-GEOGRAPHIC DATA

All non-geographic data shall be made available in the following data formats for upload to a data repository, most likely via an Application Programming Interface (API) provided by the [Donor]:

* .csv (csv output from an excel file or see rfc 4180 for standard format)
* .xls (Excel 97 and later)
* .xlsx (2007 and later)
* .tsv

### GEOGRAPHIC DATA

All geographic data shall be delivered as shapefiles, file geodatabases, or other accepted OGC standard geographic formats. See <http://www.opengeospatial.org/standards> for a list of accepted formats. Preferred formats are shapefiles for vector data, and GeoTiff for raster data. See table below for some further details:

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| **Dataset** | **Format** | **Spatial Reference** |
| Vector | Shapefile | Geographic Coordinate System: GCS\_WGS\_1984  Datum: D\_WGS\_1984  Prime Meridian: Greenwich  Angular Unit: Degree |
| Raster | Tiff, Grids, or Imagine | Geographic Coordinate System: GCS\_WGS\_1984  Datum: D\_WGS\_1984  Prime Meridian: Greenwich  Angular Unit: Degree |
| Tabular | .csv, .dbf or .xls | XY coordinates must be in Decimal Degrees |

All files pertaining to the map creation, such as .mxd or .ai files shall be included in the delivery of the GIS data.

### IMAGES

Mapping and other images shall be supplied with a 300 dpi density and lossless compression (PNG), suitable for professional printing. Mapping images will be reviewed by the [Donor]’s GIS team before going to publication to ensure cartographic quality and content. Images may be used by the [Donor] for communications purposes.

All photos shall be delivered in their original high-resolution format (raw or .jpg), preferably exif-tagged with GPS and timestamp.